

The Impact of New Collaborative Learning Spaces on Tertiary Teacher Practice

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Institutions may invest heavily into building and equipping new learning teaching spaces with the intention of encouraging active and collaborative learning to occur. However, there may not be a concomitant shift in teachers' existing pedagogical practices. This qualitative study examined the perspectives of thirty-two tertiary teachers across a range of disciplines at a single institution. The findings suggest that working in new collaborative learning spaces challenged many participants to make changes to their existing practices that moved them along a possible continuum to be more facilitative and learner-centered in their approach.

Introduction

The last two decades have seen widespread interest in the development of new formal learning spaces, designed to encourage and support active learning and supported using interactive technologies. However, there is limited research around how such new environments might affect traditional tertiary teaching practices and student learning (Brooks, 2011; Brooks, Baepler, & Walker, 2014), with a particular need for research that explores how teachers make use of new spaces, and whether or not teaching practice is changed (Fraser, 2014a; Hall, 2013; McDavid, Parker, Burgess, Robertshaw, & Doan, 2018). This qualitative study focuses on teachers' perspectives of how they learned to teach in new collaborative learning spaces and the ways in which their practice might have changed.

Literature review

The design of new generation formal learning spaces varies considerably across institutions and is still in a phase of experimentation (Fraser, 2014b). This article uses the definition from Fraser (2014b, p. xvi), in that the term 'new spaces' signifies the intent to 'facilitate collaborative, connected and active learning, ...(in spaces that) are technology-enabled and allow for students to use their own devices... as well as having comfortable furniture that is configured easily and quickly by academics and students to suit different pedagogies.' The institution in which this

study was situated uses the term 'collaborative learning spaces' to acknowledge the physical layout and the intended practices for which their new spaces are designed.

The considerable financial investment that some institutions have made in new spaces is based on assertions about the transformation potential that the use of such spaces might provide for student learning. However, there is a lack of empirical evidence in relation to student outcomes based on learning in new spaces (Brooks et al., 2014; Guiney, 2016). One often-quoted study is Walker, Brooks, and Baepler (2011), the findings of which suggest that students' learning outcomes and their perceptions of their learning experience were improved in a new formal learning environment. As well, behavior of both staff and students changed significantly. Teachers in new spaces were more mobile and interacted more with students, who, in turn, were more engaged with group experiences.

New active learning spaces can be seen, therefore, to present opportunities for new pedagogical practices, that may challenge higher education teachers' existing ways of teaching (Carr & Fraser, 2014; Ling & Fraser, 2014). While teachers may appear confident about making use of the affordances for teaching in a new space (Evans & Cook, 2014), there could well be less uptake of active and collaborative practices than institutional leadership expects (Carr & Fraser, 2014). Teaching in old ways (lecture-based format) in new spaces (designed for active, collaborative learning) is clearly not effective (Granito & Santana, 2016; Walker et al., 2011).

Gaining a better understanding of the kind of pedagogical issues that teachers experience as they move into teaching in new learning spaces is integral to research in the area (Brooks et al., 2014; Hall, 2013). The intention of this study, therefore, was to identify teachers' individual perspectives

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on specific changes made to their teaching practice as they worked in collaborative learning spaces.

Institutional context

Classroom teaching is not an isolated endeavor. Successful uptake of new spaces for learning takes place against a backdrop of organizational factors such as those identified by Carr and Fraser (2014, p. 178), which include:

- institutional policies, structures and systems
- built environment
- communities of practice
- signature pedagogies

The institutional context of this study is described briefly below in relation to these factors.

The impetus to build collaborative learning classrooms at Unitec, a large Auckland tertiary institution, was situated in a broader decision to reduce the building footprint of a sprawling campus, and to create new fit-for-purpose buildings to accommodate good teaching and learning practice. Informed by Unitec's principles of learning and teaching, a range of input was sought as to the best kind of layout, furniture and technology to support collaborative learning. Two prototype classrooms were opened in the year in which this research took place.



Image 1.

The design of the new classrooms was premised on the concept that active learning is facilitated through interaction, as groups work collaboratively on tasks (Beichner, 2014). Group seating arrangements dominate the new flat-floored collaborative learning space layout, with up to eight students around hexagonal or square desk configurations with a large group whiteboard. Technology is central to the design of the room – with Computers on Wheels (CoWs) at each group. The teacher has a larger CoW with interactive whiteboard capacity and software to enable screensharing across all CoWs. All furniture is on wheels for flexibility.

The institution's academic advisory team created a community of practice to support teacher users in the new spaces. As well, the team ran workshops for academic staff, modelling and discussing active and collaborative learning practices, to ensure that there were opportunities for all teachers to identify appropriate pedagogical practices for the new learning spaces.

Methodology

This study took place over two semesters and involved thirty-two teachers from a range of disciplines across the institution (Accounting, Computing, Construction, Creative Enterprise, Engineering, Early Childhood Education, ESOL (English for Speakers of Other Languages), Interdisciplinary Studies, Management and Marketing and Natural Sciences). The research focus was on the experiences of teachers working in new spaces, through their reflective process of sense-making over time (Ellis & Goodyear, 2016). To this end, there were two methods of data collection – weekly mini-surveys throughout the semester and focus groups at the end of each semester, allowing for teachers to reflect both in and on practice (Schön, 1987).

Weekly reflective data was collected through a Google form, the link to which was included in an email to teachers each week. Teacher participation in the reflective process fluctuated over time based on their individual teaching loads. Teachers were asked to rate themselves and their experiences on five simple statements (see questions in Appendix A). Qualitative data came in the form of their (voluntary) explanatory comments as to their ratings. As well as the five standard questions, each week a sixth question in the weekly survey was more exploratory, based on themes arising from teachers' earlier reflections and discussions in the community of practice.

Focus groups were held at the end of each semester (questions in Appendix B) and gave an opportunity for reflection through discussion with peers. Focus group attendance was 22 teachers across 4 groups.

Transcriptions of focus group discussions and text from weekly evaluative comments were uploaded to NVivo. Grounded research strategies informed the inductive analysis of data from the first semester (Charmaz, 2003), with the research team working collaboratively to develop categories from line by line coding of data (Silverman, 2004; Willis, 2007). The findings from thematic analysis are discussed in the next section.

Findings: Changes to practice

Teachers identified that the space had impacted their teaching practice in a variety of ways. Initially, teachers focused on changes that were very specific to operating in a new physical environment, addressing challenges in relation

to the space itself and managing students in the space. Over time, they identified changes to their pedagogical intentions, and how they perceived their role as teacher.

In qualitative research, themes are usually exemplified/illustrated by quotes from participants. While such quotes are included in this article, each section is also prefaced with a section from Rachel's story that demonstrates a theme, and which is followed by examples from the other thirty-two teachers. The purpose is to give a narrative voice to the kinds of changes in practice made by one teacher situated in a single class, and then identify how themes relate to the broader population of teachers in the study.

Introducing Rachel

Rachel was one of more than twenty teachers in the second semester group. She was teaching an accounting course with 45 students in their first year of tertiary study. An experienced teacher, she volunteered to discuss the changes she had identified in her practice. Her narrative illustrates in detail the broad themes that have been drawn from the wider participant data.

1a. Managing what happens in class

Many participants' initial comments related to what they do in the space in relation to standard classroom processes, such as giving instructions, or how they managed activities in the class. Rachel described how preoccupied she was initially with getting used to working in the new space.

Rachel: I've taught the course before, but this semester I had 45 students in the class. The first few weeks were about getting my head round teaching processes, such as how to make transitions in class between using technology, focusing on data, teaching students and making material available for them. Sometimes you lose students if you look incompetent. It took time to get used to the touch screen on the teacher CoW (Computer on Wheels). I didn't like having my back to the class while I focused on getting material onto the screen, and I felt I had less time than usual to establish relationships with the students.

You really need to be well set up before class but also to be flexible. I found it useful to have some alternative processes in my mind as back-up in case something didn't work quite the way I thought it might. Initially, I kept a reflective log after each lesson of what worked and what I'd learned that day.

I need to keep working at being engaged with students. Because of working in groups, I'm less likely to know everyone's names than I would be in a teacher-fronted space. In a standard room, I would be questioning, I would have names for many of the students and I

would have a visual recognition for them from week 1. I am still working on how to achieve this in these new types of working space.

Students know what is expected of them now in this space. We've formalized routines, like logging in and out of the CoWs and leaving the room tidy. Also, sometimes students come in and get started rather than waiting for me to start the class.

I love that I can walk round groups in this space, whereas in my other teaching space (a tiered small lecture room) it is much easier for students to hide. Group work was all but impossible. It's easier to hide in a lecture room than this kind of class. I'm more relaxed about students sitting on the sofas (break out spaces) in the room now. At first, I was a bit worried about them but now I don't really think it makes much difference where they sit. Same with technology – some students really like to work on the group CoW, while others tend to use their iPads for individual work.

The changes noticed by Rachel match the perspectives of other teachers in relation to:

- establishing patterns and routines
- becoming familiar with technology use
- using the physical space appropriately with respect to
 - layout
 - movement
 - time, pace and transition

1b. Other teachers' perspectives on managing the classroom

The 32 teachers in the study described changes made as to how they structured what happened in the classroom. For some participants, this involved establishing patterns and routines for students arriving in the class. For others, it was about finding the most effective way of giving instructions. Teachers discussed the value of keeping instructions short, of reducing teacher talking time and of using different ways for managing what happened in the classroom, such as different modes for instructions.

Technology was an initial barrier for these teachers in the use of the space, complicated by the initial prototype nature of the rooms with on-going troubleshooting. Often this caused frustration, and participants retreated to what they identified as using low-tech (such as the whiteboards), suggesting that in the future they would explore more technological options 'once everything works seamlessly'. The technology needed to work for them as a teacher and for the activities that they had planned.

However, there was agency in relation to addressing technological issues. Being prepared for technology not to work was important. As one teacher stated, 'I was prepared mentally for some sort of a "disaster", which luckily did not happen.' Several individuals identified a need to improve

their troubleshooting abilities with technology, and sought help from students, from academic advisors and from IT help. Over time, teachers felt that their understanding of the basic tools in the room improved. 'I feel as though I am getting better with the technology that I am using but I know that there are still lots of new skills to be developed in this room.'

The physical space prompted different responses from teachers. Generally, they liked the layout of the classrooms. While some teachers were unsure about the need for break-out spaces, others appreciated the options it gave students. The lack of teacher-center in the room was problematic for some teachers, and special effort (and rearranging of furniture) was required at times to ensure teacher visibility by the students, especially in the larger classroom (100 students). Teachers had mixed opinions about using the microphone (whether a headset or hand-held). While some enjoyed the freedom to move around the room using a headset for instructions and comments, many were reluctant to use the microphone at all.

Teachers (particularly with less full classes) enjoyed the freedom of movement they had in the new space and were positive about being able to access students and engage small groups in conversation. Several teachers identified the value for students in being able to move around, whether it was to check out what other groups were doing, or to write on their group whiteboard. Some teachers deliberately planned a balance between movement and concentrated group discussion. Another advantage seen in the space was that students couldn't 'hide' as easily as they might in a lecture space, as Rachel commented, and several teachers mentioned that they found 'dysfunctional groups' easier to manage in this space, while others were happy for the most 'autonomous group' to be more isolated in a corner of the room.

Managing time, pace and the transition between classroom activities was important for all teachers. They identified ways of helping groups be aware of time allocations, and the need to allocate more time to collaborative group work, as well as allowing 'more time in each session for technology use, training, logging in, troubleshooting'. They discussed various ways they had experimented with moving students between whole class time to small group activities. Sometimes, this proved harder than they had expected, especially when groups were engrossed with an activity and reluctant to move back to be more teacher-directed.

2a. Pedagogical intentions - shift to focus on student learning

Rachel describes how she gained confidence working in new spaces over time, and she identifies a shift to focusing

on student learning and activity rather than on content delivery.

Rachel: 'I believe that it takes time to figure out what works for you in a new learning space. A minor change in how the technology worked really threw me in week 4, but I coped OK by having an alternative up my sleeve. Coming back after the break I felt a lot less nervous than I did in the first half of semester. I guess the content itself is much the same, but the delivery is different. I now provide more links to course work. Some work has been adapted for online capture of answers, both the working and results. I have reduced the amount of board work that I normally do.'

*I found that after 7 or 8 weeks, I started to think about what I wanted my students to do during class, rather than what I was going to do. This made a huge difference. It wasn't my habit to plan what students would **do** in the classroom, but I've found that this is actually much more useful for learning than concentrating on what I'm going to 'deliver'.*

I'm much more confident now with what happens in the new space. I focus on student learning when I...

- make content available up front for students – resources, Excel templates, ebooks
- link learning outcomes from last week to what's happening today
- keep teacher talk from the front to a minimum
- explain where we're going in this lesson and then students do problems while I go around to groups to help

The students really like this collaborative space. It is a very comfortable learning environment. It allows for movement without disturbing others, is non-disruptive when students come in late and comfortably accommodates physically larger students. Overall, students' use of the technology is improving - some have always been confident, and this seems to be rubbing off onto the less confident. Students are engaged and are becoming quite efficient with their technology use. There is a lot of sharing of skills taking place. The whiteboards and screens are great for visibility. Students look at each other's work which I think supports their learning.

An example of a group task I do is that students will bring up a spreadsheet on their screen and work individually or in pairs to solve problems. They then compare notes and put a combined version on the screen. I'm able to walk around and see what is happening and can give instant feedback and address any issues. Sometimes I must help them get started or adjust fundamental errors. I can extend discussion and point a group in the right direction if they are off track. If a group is doing something well, I can flick the screen round to the whole class and get the group to

explain what they are doing. I am definitely more accessible to the students in this room.'

It took time for Rachel's pedagogical intentions in the new space to cohere, based on her observations of what worked for her and for her students. Her focus moved from a concern with content delivery to become much more student-centered. While Rachel was quite explicit about this in her reflective narrative, most teachers did not identify making this shift specifically. The areas they commented on are described further in the next section and relate to:

- reducing content in class time
- adapting classroom activities to be more learner-focused
- managing group work
- changing/reflecting on existing practices
- talking with their students about shifts in practice

2b. Other teachers' perspectives on pedagogical shifts in intention

Teachers were very clear that the room layout in groups didn't work well for content delivery. A handful of teachers appeared to make minimal changes to existing pedagogy, continuing with a transmission approach. Several teachers used the flexible furniture to get students to move chairs to create a 'lecture space' at the beginning of class, and then to move into group activities.

However, many teachers felt compelled to make changes to their usual methods of content delivery in previous lecture spaces. A significant number reduced their lecturing in the new space. In some instances, content was shifted online, with a flipped approach being used. Others described having less 'whole-class talk' or of being happy to 'achieve less' in class time. Teachers talked about getting 'more from less' in relation to content. One teacher identified that she was relying less on her PowerPoint slides for teaching, and more on a collection of online resources, and suggested that this helped her content delivery to be less linear and more responsive to students' immediate needs.

Most teachers made some use of the group layout to support collaborative activities. One participant said she was no longer simply talking to bullet points on slides but instead 'finding tasks that get students to go deeper'. Those who were already using team-based learning found the classroom well-suited to this approach. A construction lecturer's advice for new teachers to the space was, 'The space automatically lends itself to fostering engagement. Don't get in the way of that!'

Many comments in the focus groups and weekly reflections centered around managing group work for effective learning. Some teachers were very deliberate about their choices for constructing groups. Soft skills were seen as

crucial to successful engagement in the new spaces. Teachers agreed on the importance of establishing group work skills at the beginning of semester. Another aspect that was seen as problematic was managing feedback from groups to the whole class once group tasks were completed. One teacher highlighted the importance of feedback from group activities contributing to knowledge construction: 'Ensure you have different activities for each team to share with whole class'.

Teachers' pedagogical intentions for their students differed in relation to their individual beliefs about and experiences of learning and teaching. Some teachers were appreciative that the room layout and technology allowed them to teach in ways that they had always tried to, but which had been more challenging in tiered lecture rooms. They wanted to engage learners in collaborative activities that supported knowledge construction. As one teacher commented, 'I guess I have always tried to teach in the way I do in (the new classroom), but this space allows it to happen more easily. I give more time to 'practice'. I encourage more inter-group collaboration because the space lends itself to this.' However, other teachers' comments suggested their focus on content delivery had been compromised through teaching in new physical environments, and that they were beginning to develop new concepts of how learning and teaching might occur.

For all the participants in the study, the physical move to new spaces meant that teachers had to put more thought into what they were doing – it required more effort than 'business as usual'. Teachers generally agreed on the need to do more planning before class than they were used to, although for several teachers the amount of planning they did actually decrease over the semester, possibly because they became more comfortable in the spaces over time. There was also mention of the importance of reflecting on classroom experiences. As one teacher said, 'you need to think about how to teach before you teach'. Several reiterated the need to be open to pedagogical change and not simply replicate the same approaches used in more traditional spaces.

The value of being more explicit about learning and teaching intentions with students was identified by teachers. Students, commented one teacher, need to know 'how they are expected to learn in the new space, how to get questions answered, who is the 'authority' figure (or not!) in the room.' An ESOL teacher sought feedback from her class early in the semester, in order to resolve potential challenges to learning. Her students identified the need to cooperate better in groups. Other teachers agreed that it was difficult at times to persuade students of the value of active learning, but that it was the teacher's responsibility to explain reasons for using the new space and to 'sell it better'.

3a. Changing role to be more facilitative

Finally, Rachel describes shifts in her role as teacher that are related to teaching for a semester in a new classroom space. She asserts what is important for her, but recognizes change she would like to see happen in relation to the possibilities for student learning in the space.

*Rachel: I think I'm still trying to teach rather than facilitating. I still want to be in control of the room and what's happening. I want students to be on task, and for me to be directing what happens. However, I think I **am** learning to facilitate learning in this new space and I certainly have a better perspective on what individual students are doing.*

I'll continue to keep working on using the interactive whiteboard better, as I'm a big board user. I need to spend time finding out what the interactive board can do and decide what is useful for my students and for me. I've already cut down what I write on the screen but intend to do more planning on what I will write during class, which students can then have as notes.

Overall, it's been quite exciting using this space for me personally. I feel that I've been able to make the course much livelier. However, it has challenged my teacher identity, I think. I've had to learn a lot about technology and consider what I do from a teaching perspective and what I get my students to do as learners.

Rachel identified a difference between teaching and facilitating. Several other teachers similarly commented that in the new spaces they felt 'less of a lecturer and more of a facilitator'. There were several ways in which these teachers described becoming more facilitative:

- being less in control
- responding more to students
- changing their perspective on content
- adapting to team teaching

3b. Other teachers' perspectives on becoming more facilitative

Teachers identified that they were no longer the central authority in the class. Several identified that they had to 'accept' less control in new spaces. 'I have less control over what students are learning'. Other teachers observed that the group layout and the technology had minimized their 'power' in the classroom. A foundation studies teacher summed this tension up:

'I wonder if one of the most profound communications of the room is who's in charge of learning, and where learning comes from. I think instead of students relying on the teacher, they are now looking to the screen as the teacher... There are pros and cons to this of course;

however, it does put control into the hands of the learner. It allows more curiosity and enquiry - individuation of learning.'

Teachers coped in different ways with the sense of 'losing control'. An engineering teacher was reconciled to not being listened to by the class when he gave instructions. 'It is more chaotic than a conventional classroom so getting full class attention takes longer but you do not need to have the whole class listening as you do in conventional lectures.' Other teachers described their role changing to be more about 'conducting groups'. 'I'm more like a primary school teacher', said a management teacher.

Giving up control enabled teachers to be more responsive to their students. Many participants mentioned that the room had enabled them to give more opportunity for student initiative. As one teacher said, 'I had to let go control of group work and be comfortable with them going off on a tangent'. Participants felt they were able to respond to students in the moment, extending conversations or encouraging group members to support and extend each other. However, to support knowledge development, teachers liked being able to monitor group work. As Rachel put it, 'I can give instant feedback and address any issues.' One teacher expressed surprise that 'half my session is responding to students!'

As mentioned in section 2b, teachers identified that simply delivering content was not an effective use of the new spaces. They facilitated learning by creating appropriate group tasks and some mentioned providing online resources for students to access. Reducing content covered in class also allowed space for a skills/competency focus. While some had deliberately taught group-work skills, several teachers identified that, in future use of new spaces, they would work on developing students' soft skills, with group-work, digital literacy and web navigation being mentioned specifically.

Task design allowed teachers to be in a facilitative role. One lecturer appreciated that using group projects allowed students to drive what was happening in class, while another said, 'I run through the tasks with them at the beginning of the class, and I monitor and provide feedback and suggestions during the class as needed - much like a normal class really, but the tasks are different. They are mostly group tasks which lend themselves to minimal teacher input from the front of the class.'

Rachel was teaching by herself in the space (as did most of the teachers in the study), but those who were team-teaching (with classes of up to 100 students) identified specific ways in which, as a team, they facilitated learning. Team teaching meant adopting different roles - sometimes managing the overall pace of group work and at other times working to support individual groups. While one teacher might direct

whole class discussion, two other teachers would move around groups offering microphone access to different students who wanted to contribute. Team teachers felt it was important to work intentionally to ensure teacher presence around the room was visible and allowed for teacher contact with individual groups.

Discussion

The findings from this study are discussed in relation to two ways in which teachers were challenged to make changes to their existing practices through working in new collaborative learning spaces. Change in practice was in response, firstly, to the physical design of the space and secondly, to the fact that teachers' existing pedagogical practices were not always as successful as they had been in more traditional classrooms. These headings echo similar challenges identified in a study by Petersen and Gorman (2014), which related to a) the physical layout of the room and b) the change in teaching roles.

Change in response to the design of new spaces

Entering one of the new spaces, teachers were immediately confronted by two distinct aspects of physical layout – group spaces and the prominence of technology. These two aspects clearly contributed to teachers' changing practice.

The layout of the room in small groups impacted on teacher behavior. Having no obvious 'front' to the room meant that teachers struggled to know where to stand to have eye contact with all students. Many found that their existing lecture style was not very effective because of this, as other studies have identified (Van Horne et al., 2014). Line of sight was problematic for these teachers, as in Benoit's (2017) study, as the 'zoning' of the room, with the whiteboard and large CoW for each group, prioritized group work. As a result, several teachers felt they needed to explore different ways to engage students with content, rather than relying on the traditional lecture. The freedom to move around the classroom easily, as other studies have identified, (Rands & Gansemer-Topf, 2017; Walker et al., 2011; Zimmermann, Stallings, Pierce, & Largent, 2018), allowed teachers to have better access to and interaction with individuals and groups of students than they had in a lecture theatre.

The technology available in the collaborative learning spaces also challenged teachers initially, and many expressed their need to learn more about the available tools. Although teachers were clear that technology should support their pedagogical intentions, it appeared that use of new software and tools to enable new ways of students working collaboratively needed to be made more explicit to

teachers in order to support change to pedagogical practices (Carr & Fraser, 2014, p. 191).

Rachel's story illustrates the transition she went through over the period of a semester. Her initial time in the room was concerned with translating micro-aspects of teaching to work in a new space. Other teachers shared this pragmatic approach, operating very much on a need-to-know basis, setting routines for students and discovering how to effectively manage the classroom in ways that worked for their existing teaching styles. Teachers seemed to focus on their personal ability to teach in the space, especially managing the tasks and logistics of using new layouts and technology.

Change in pedagogical intentions

Rachel describes her explicit shift during the semester to a role that was more facilitative, focusing on what her students were doing, being responsive to learners and considering how tasks could enable active learning. Other teachers made similar shifts to be more learning-centered, recognizing that their practice needed to move in response to the physical and technological affordances of the space. Those teachers who already used collaborative activities in the classroom were working out how to improve existing practices, such as getting group feedback, or supporting group activity. Teachers' varying responses to working in new spaces suggest that the pedagogic intentions of participants might be pictured along a continuum of becoming more learning-centered (Figure 1).

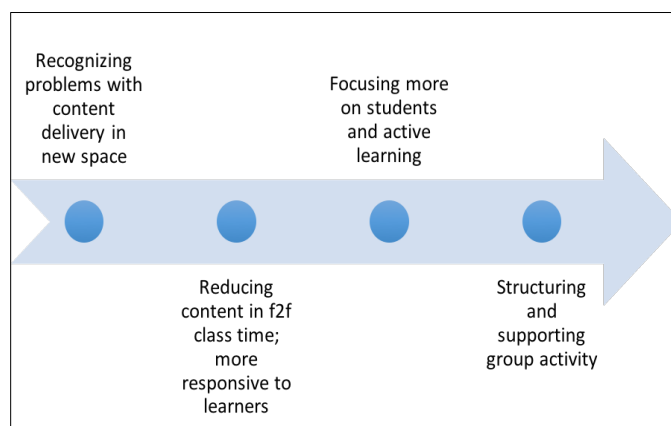


Figure 1. Aspects related to pedagogical focus identified by teachers working in new spaces

Figure 1 identifies aspects in the process of teachers becoming more facilitative: from being highly teacher-centered and concerned with knowledge transmission (on the left) to focusing on learner activity, within a collaborative environment (on the right). This study made no attempt to analyze individual teachers' pedagogical intentions or

where they might place themselves on this cline, nor did it look for evidence as to whether one way of teaching might have more effect on learner outcomes than another.

External considerations such as curriculum imperatives around content may cause problems for teachers who are interested in becoming more facilitative. One of the ESOL teachers in the new spaces identified a tension between getting through course content and a focus on learner activity. 'Using a more student-centered approach is at complete variance with "covering the material". There are big implications for course design - we need to have less "content" and more visible engagement with it.' Enacting such a shift can challenge teachers. As another participant said, 'teachers need to be expert in both content **and** facilitation skills' (emphasis added).

The careful selection process for choosing this cohort of teachers to work in new spaces in the first year may account for the general openness that these teachers displayed with regards to their learning to work in new spaces. Along with their developing understandings of how to teach in these rooms, they had the courage and motivation that Carr and Fraser (2014) see as crucial to support risk-taking in new learning spaces. Many were coming to understand, through their lived experiences, the potential shifts in what a teacher might do in new spaces, facilitating students to become more responsible for their own learning (Ling & Fraser, 2014).

Implications for professional development based on this research are the need to allow teachers time to practice with technology, as well as exploring together how best to support collaborative learning experiences. Establishing a community of practice (whether online or face-to-face) allows teachers to share their experiences and problem-solving in new spaces. Giving teachers opportunity to re-imagine their pedagogical beliefs and intentions **before** working in a new space, as Steel and Andrews (2012) suggest, could help teachers to identify steps, as illustrated in Figure 1, towards more learning-centered practice. As well, the themes described in the findings (in table format in Appendix 3) may provide useful prompts for developing teacher inquiry, and teachers themselves may identify approaches (such as flipped or team-based learning) that may work better in a collaborative classroom.

Conclusion

The characteristics of a room may not in themselves lead to significant changes in pedagogy (Brooks et al., 2014; Ellis & Goodyear, 2016). However, this study suggests that teachers may well consider and adapt aspects of existing practice based on their experience of how physical space and available technology can afford and constrain student learning and their teaching.

Influences not accounted for in this study are the individual contexts and backgrounds of different teachers, their specific disciplines and their explicit beliefs about learning. Future research could investigate longitudinally the degree to which changes in beliefs about teaching and learning and consequent behavior changes transfer to other spaces that teachers work in, such as online environments, lecture rooms and computer labs.

The demands on teachers working in new environments are considerable. Not only do they need to have sufficient in-depth knowledge of their subject so they can move away from their PowerPoint slides (as mentioned by teachers in this study) and field questions on-the-fly (Fahlberg, Rice, Muehrer, & Brey, 2014), they need the ability to interact socially with students in what Baepler and Walker (2014, p. 29) call educational alliances, that require socio-cultural skills beyond those used in traditional lecture theatres. As well, staff need to be able to use new technologies with ease and design ways that new tools can contribute effectively to active student learning. Finally, teachers in new learning spaces need to be able to design for active and collaborative learning and to be aware of emerging pedagogies that utilize the affordances of new spaces. While moving teaching practice to engage students in a more active style of learning is challenging for teachers (Olsen & Guffey, 2016) and takes time, this study identifies some of the shifts in pedagogical focus required for teacher practice to become more facilitative and student-centered in new learning spaces.

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Appendix A

Weekly questions in a Google form, using Likert Scale. Qualitative data described in this study was informed by teachers' comments in response to the question that followed each of the below. I.e Clarify or explain your answer in more detail if you wish.

1. How easy is this collaborative learning space to use?
2. To what extent are you customizing this space to enhance learning and teaching?
3. How confident are you with using the technology available in the space?
4. To what extent are you using the technology available in the space?
5. To what extent do your learners seem comfortable in this space?
6. To what extent does the space create opportunities for learners to be engaged?

Question 7 changed each week depending on issues that arose from teachers. Three examples are included below

- How important are the student CoWs for your learners? (week 3)
- Reflecting on your use of the new space, have you made any changes to the way you teach? (week 6)
- Would you recommend the prototype space to your colleagues as a good place for teaching and learning? (Week 13)

Appendix B: Questions for focus groups

In relation to the new teaching spaces what main surprises have you had in relation to

- students
- teaching
- technology

What would you change about your experience if you could?

What have you had to change about what you do in teaching?

Has your role changed? How?

Overall, what is different about planning and delivery of the learning?

Would you say you've noticed any improvement in student outcomes? What do you put this down to?

Appendix C: Themes from findings

| Managing what happens in class | Pedagogical intentions - shift to focus on student learning | Changing role to be more facilitative |
|--|--|--|
| <ul style="list-style-type: none"> • establishing patterns and routines • becoming familiar with technology use • using the physical space appropriately with respect to <ul style="list-style-type: none"> ○ layout ○ movement ○ time, pace and transition | <ul style="list-style-type: none"> • reducing content in class time • adapting classroom activities to be more learner-focused • managing group work • changing/reflecting on existing practices • talking with their students about shifts in practice | <ul style="list-style-type: none"> • being less in control • responding more to students • changing their perspective on content • adapting to team teaching |